

REMARKS/ARGUMENTS

Applicants first wish to thank Examiner Crepeau for his indication of allowable subject matter. Reconsideration of the above-identified application is respectfully requested in view of the foregoing amendments and the following remarks. Claim 1 has been amended. Claims 2 - 9 have been cancelled. Claims 1, and 10 - 14 remain in the case.

The claims of the instant application are drawn to a direct oxidation fuel cell which is capable of directly oxidizing a variety of liquid secondary alcohol fuels.

Claims 1 - 14 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written enablement requirement. Claim 1 has been amended to cancel the recitation of "and absent an acid", thereby overcoming the rejection of claim 1 and claims 2 - 14 depending therefrom.

Claims 1 - 5, 8, and 10 - 13 were rejected under 35 U.S.C. §102(e) as being anticipated by United States Patent No. 6,492,047 for FUEL CELL WITH PROTON CONDUCTING MEMBRANE, issued December 10, 2002 to Emanuel Peled et al. PELED et al. teach a fuel cell capable of directly oxidizing alcohol fuels (e.g., methanol, glycerol, ethanol, isopropyl alcohol, etc.). While PELED et al. mention isopropyl alcohol (2-propanol) (column 3, line 46), there is no enablement for its use as a fuel. PELED et al. list several other fuels: "Examples of new fuels are glycerol, ethanol, isopropyl alcohol, ethylene glycol and formic and oxalic esters thereof, oxalic acid, glyoxylic acid and methyl esters thereof, glyoxylic aldehyde, methyl format and dimethyl oxalat." Several fuels from this list are extensively discussed and evaluated by PELED et al. For example, PELED et al. FIGURE 8 provides performance comparisons of methanol, oxalic acid/methanol, dimethyl oxalate, oxalic acid, glycerol, and ethylene glycol. Isopropyl alcohol is conspicuously absent. In fact, THE term "isopropyl alcohol" appears ONLY once in the PELED et al. specification and the term "2-propanol" does not appear at all. Case law has consistently upheld the fact that a reference must be enabling to be anticipatory (*Symbol Technologies, Inc. v. Opticon*, 19 U.S.P.Q. 2d 1241, Fed. Cir. NY, 1991).

Conventional wisdom has heretofore been that isopropyl alcohol was an unsuitable fuel for direct oxidation fuel cells

as it exhibited very poor performance. For example, in *Evaluation of Ethanol, 1-Propanol, 2-Propanol in a Direct Oxidation Fuel cell*, Journal of the Electrochemistry Society, (12) 4218-4224 (1995), J. Wang et al. conclude "both 1-Proanol and 2-Propanol are not suitable as fuels for DMFCs because of their low electrical activity." Consequently, the prior art teaches away from the invention as claimed.

Applicants, however, have pioneered work in creating direct oxidation fuel cells capable of efficiently utilizing isopropyl alcohol as a fuel. In point of fact, when Applicants' discovery was published Applicants were invited to present papers regarding their findings in several prestigious journals.

Claim 1 has been amended to recite fuels comprising 2-propanol, propylene glycol ($\text{CH}_3\text{CHOHCH}_2\text{OH}$) (originally recited in claim 6), glyceraldehyde ($\text{CH}_2\text{OHCHOHCOH}$) (originally recited in allowable claim 7), and the list of short chain alkanones: propanone (CH_3COCH_3), butanone ($\text{CH}_3\text{CH}_2\text{COCH}_3$), and pentanone ($\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3$, $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$), originally recited in allowable claim 9. As PELED et al. fail to provide enablement for the use of 2-propanol, amended claim 1 is now believed allowable.

Claims 2 - 4, and 8 have been cancelled rendering their rejection under 35 U.S.C. §102(e) as being anticipated by PELED et al. moot. The subject matter of original claim 4 has, however, been added to claim 1.

With regard to claims 10 - 13, it is believed that the amendment of claim 1 puts claims 10 - 13 depending therefrom in condition for allowance; claims 10 - 13 now merely recite additional limitations to now allowable claim 1.

Claim 6 was rejected under 35 U.S.C. §103(a) as being unpatentable over PELED et al. in view of United States Patent No. 6,383,670 for SYSTEM AND METHOD FOR CONTROLLING THE OPERATION OF A FUEL PROCESSING SYSTEM, issued May 7, 2002 to David J. Edlund et al. The Examiner has relied upon EDLUND et al. only to support the use of propylene glycol as a fuel. However, EDLUND et al. neither teach nor suggest the use of propylene glycol in a direct liquid (i.e., direct oxidation) fuel cell. Rather, EDLUND et al. teach reforming propylene glycol (i.e., in a fuel processor) to generate hydrogen which acts as fuel in an INDIRECT fuel cell. This may clearly be seen in EDLUND et al. FIGURES 1 and 2 wherein fuel (e.g., propylene glycol) from feed assembly 18 is supplied to fuel processor 16. Fuel processor 16 generates hydrogen which is,

in turn, supplied to fuel cell stack 14. A more detailed diagram of fuel processor 16 is provided in FIGURE 2 where it may be seen that the hydrogen producing region 34 actually receives a liquid fuel (i.e., feed stream 20) and produces hydrogen. In EDLUND et al., no propylene glycol ever reaches the fuel cell stack 14.

In Applicants' fuel cell, liquid fuel (i.e., propylene glycol et al.) is directly oxidized at the fuel cell stack without need of a separate reforming step as taught by EDLUND et al. The chemical reaction involved in reforming (EDLUND et al.) and direct oxidation (Applicants' application) are completely different. The reforming of propylene glycol is well known in the art. This, however, in no way suggests the use of propylene glycol as a fuel in a direct oxidation fuel cell.

Because claim 6 has been cancelled, its rejection under 35 U.S.C. §103(a) is moot as being unpatentable over PELED et al. in view of EDLUND et al. However, the subject matter of now cancelled claim 6 is now recited in claim 1.

Claim 14 was rejected under 35 U.S.C. §103(a) as being unpatentable over PELED et al. in view of published United States Patent Application No. 2003/0022033 for FUEL CELL WITH PULSED ANODE POTENTIAL, published January 30, 2003 upon application by Ulrich Stimming et al. Claim 14 has been amended to recite the reversal of the anode and cathode potentials of the electrochemical cell as supported on page 13, lines 20 - 21. This process is neither taught nor suggested in either PELED et al. or STIMMING et al. It is believed that this amendment overcome the rejection of claim 14 under 35 U.S.C. §103(a) over PELED et al. in view of STIMMING et al.

Claims 7 and 9 were found allowable. Both claims 7 and 9 have been cancelled, their subject matter bring moved to independent claim 1.

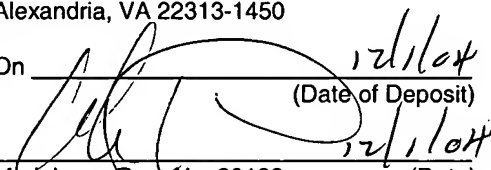
Applicants respectfully request that claims 1, and 10 - 14 be allowed and the application passed to issue.

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